



*...Experts in Automatic  
Loading and Unloading*



*Height adjustable AGV with*

*↻ rotating turret*

## Automatic Loading and Unloading Systems

PennTech's customized Automatic Loading/Unloading Systems can be installed as part of a new freeze dryer installation and as retrofit with almost all existing freeze dryers.

### Flexibility

PennTech's Automatic Loading and Unloading Systems can serve single or multiple freeze dryers on either side of the cleanroom. Even freeze dryers with different loading height can be loaded and unloaded by the same system.

### Choice of systems

The choice is governed by the line layout:

- Infeed Station + fixed AGV\* + Outfeed Station
- Infeed Station + rotating AGV + Outfeed Station
- Infeed/Outfeed Station + fixed AGV
- Infeed/Outfeed Station + rotating AGV

### Each system can be equipped with:

- Laminar Air Flow units (LAF)
- Open Restricted Access Barrier System (o-RABS)
- Closed Restricted Access Barrier System (c-RABS)
- Isolator

\* AGV: Automatic Guided Vehicle

## Unique benefits

- The single transport rail is located below the freeze dryer. No trip hazard; less cleaning.
- Variable AGV loading and unloading height. Lyo shelf height between 850-1150mm.
- Automatic micro height adjustment of the AGV with lyo shelves. Always the exact loading height; always the exact unloading height.
- The AGV will automatically adjust to the pitch of the lyo shelf to ensure proper alignment between the AGV shelf and the lyo shelf.
- Row-by-row loading and unloading first vial in, last vial out. The exact location of each vial can be traced during the entire process.
- Automatic removal of vial and stoppers stuck to the shelf above. "Hanging" vials can automatically be pushed back into the vial pack before unloading. (optional)
- Automatic dislodging of vials that stick together during the unloading phase.

*Vial transfer AGV to Infeed/Outfeed Station*





## Functioning

**During the loading phase** the Infeed Station is automatically loaded row-by-row in a “nested” pattern with partial stoppered vials. The nested loading pattern assures a solid pack of vials and optimizes the available shelf space.

Upon completion, the loading pusher creates a space between the current vial pack and the next.

The AGV vial containment ring surrounds the vial pack on the Infeed Station with the front gate in the “up” position. When fully extended, this gate lowers and the vial containment ring retracts to its home position, moving the vials onto the AGV.

The AGV moves along the rail towards the freeze dryer. If the freeze dryer is on the opposite side of the Infeed Station, the AGV automatically rotates 180°. Concurrently, the AGV is automatically adjusted to the shelf height in the freeze dryer.

Even if the lyo shelf height is inconsistent, the AGV shelf “finds” the exact height automatically. Even when the lyo shelf is pitched, the AGV shelf will adjust itself automatically to the same pitch.

**During the unloading phase**, the AGV shelf finds the correct height and pitch of the lyo shelf. Due to its variable height settings, the vial containment ring is able to remove the “hanging vials” from the shelf above and push them back into the vial pack. The vial containment ring retracts to its home position, moving the vials onto the AGV.

On its way to the Outfeed Station, the AGV rotates 180° and lowers to the height of the Outfeed Station.

The AGV extends and loads the vials onto the Outfeed Station.

A second pusher, the “flying” pusher, is positioned behind the vial pack. The vials are now contained at all four sides. The integrated movement of the two pushers guarantees a perfect row-by-row discharge of the vials onto the outfeed conveyor to the capping machine.

Vial are loaded and unloaded in strict sequence, so that the location of each vial can be tracked during the entire loading and unloading process.

*Nested Vial Pack*

## PennTech's approach to Process Analytical Technology (PAT)

Risk	Solution
Fallen vials before entering the Infeed Station	Remove fallen vials before entering the Infeed Station*
Displaced stoppers	Remove displaced stoppers from the conveyor before entering the Infeed Station*
Product Sloshing	Decelerate vials gradually when entering the Infeed Station
Stoppers falling from vials during loading	Decelerate vials gradually when entering the Infeed Station
Vials falling during loading and unloading	Positive control over the vials from all sides
Lyo shelf height variation during loading	Automatic height adjustment of AGV shelf (0.5mm higher than lyo shelf)
Pitched lyo shelf	Automatic pitch adjustment of AGV shelf
Vial/stopper stuck to shelf above	Remove vial/stopper and push them back into the vial pack*
Lyo shelf height variation during unloading	Automatic height adjustment of AGV shelf (0.5mm lower than lyo shelf)
Sticky vials during unloading	Dislodge vials prior to discharging

*\*Optional*

### Automatic Loading and Unloading Systems

PennTech's Automatic Loading and Unloading Systems are constructed of heavy duty stainless steel, and are fully servo-motor driven, with minimum of hardware and a highly sophisticated menu-driven software program.

*Vials from filling line to Infeed Station*



## LASER-Guided Systems

Existing cleanroom layouts may not lend themselves to an AGV that moves along a fixed rail. The solution here is a LASER-Guided Vehicle (LGV). LGV's have been around for many years in various industries. One of the challenges with LGV applications is the exact positioning of the LGV in relation to the shelves of the freeze dryer(s) and the Infeed and Outfeed Stations. The typical accuracy of LASER-Guided Vehicles is +/- 5mm. not accurate enough for Automatic Loading and Unloading of freeze dryers.

PennTech has solved this issue by applying cones mounted in the floor in front of the freeze dryer and the In/Outfeed Stations. LGV's are now being positioned with pin-point accuracy.

PennTech's LGV's function in exactly the same manner and have the same features as PennTech's AGV's. The only difference is that the super structure of the LGV does not need to rotate 180°, as the whole unit can rotate within its own footprint. LGV's are self-contained systems with their own power supply to allow the transportation of vials under class-A conditions. The power supply system is in most cases powerful enough to load or unload the entire batch without recharge.

### Navigation

The LGV carries a LASER transmitter/receiver on a rotating turret. Navigation is done by retro-reflective plates mounted on the walls in the cleanroom. A continuous LASER is transmitted and received from the reflective plates. The angle and distance of the LGV in relation to the reflective plates are continuously updated in the LGV's memory, allowing it to automatically calculate its position in the cleanroom.

A recharge station, or LGV home-base, is part of the installation and consists of a wall-mounted low voltage recharge plate. The LGV automatically returns to its home base if not in use or during the loading and unloading process.

**LASER Guided Systems offer unequalled flexibility in floor plan layout of the aseptic facility.**



*AGV with c-RABS*

## Semi-Automatic Loading and Unloading Systems

In case the existing facility does not lend itself to an Automatic Loading and Unloading System, a Semi-Automatic System may be the equipment of choice.

The loading and unloading unit (the Transfer Vehicle) is manually positioned in front of the freeze dryer or the Infeed or Outfeed Station.

Like the Automatic System, the shelf height of the Transfer Vehicle is height adjustable. In addition it automatically adjusts itself to the precise height of the lyo shelf during loading and unloading.

With a Semi-Automatic Loading System (in most applications) the lyo shelf is loaded in two halves (first left then right side). This is due to the size of the lyo shelf relative to the shelf of the loading system.

The positioning of the Transfer Vehicle is aided by cones in the floor, guaranteeing the exact positioning of the Transfer Vehicle in relation to the shelf in the freeze dryer.

During the transport of the Transfer Vehicle to and from the freeze dryer, class 100 conditions are maintained due to a self-contained rechargeable power supply.



*Semi-Automatic Loading System*



PennTech-Autoloaders, LLC.  
103 Steamwhistle Drive  
Ivyland, PA 18974 USA  
Telephone: 1-215-396-2200  
Fax: 1-215-396-6774  
[www.penntech-corp.com](http://www.penntech-corp.com)